Governor's Water Augmentation, Innovation & Conservation Council

A GUIDE TO SELECTING UNDERGROUND WATER STORAGE AND/OR AQUIFER AUGMENTATION SITES

INTRODUCTION

This document provides resources and information that individuals and groups can use as a guide when evaluating underground water storage and aquifer augmentation potential on public or private land, including Arizona State Trust Land. The considerations outlined in this guide may not apply to all projects. Additionally, certain projects may raise unique issues not addressed in this guide. It is advisable to work with legal and technical consultants in connection with any proposal.

ADWR authored this guide with input from the Arizona State Land Department (ASLD) and the Governor's Water Augmentation, Innovation, and Conservation Council (Council) Storage Sites Subcommittee.

We would like to acknowledge Arizona State Representative Gail Griffin (District 14), an active member of the Council and the Storage Sites Subcommittee and a proponent of facilitating additional water storage and aquifer augmentation in Arizona. Representative Griffin sponsored HB 2249 (Chapter 33, Laws 2021), which includes a provision requiring the State Land Commissioner and the Director of ADWR develop a plan to create additional water storage in Arizona that includes preliminarily investigating acceptable sites to construct new water storage facilities on State Trust Land.

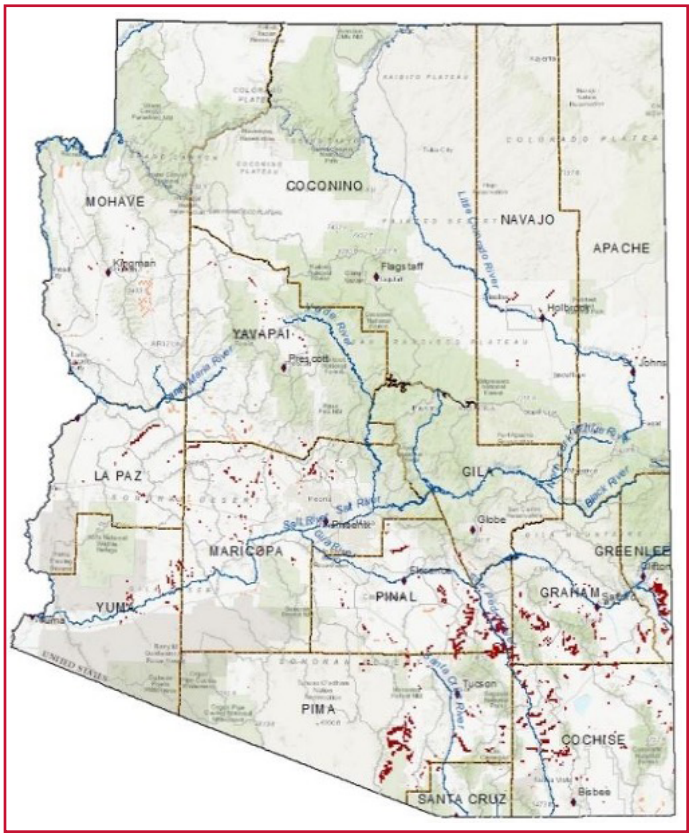

Figure 1. Potential Underground Water Storage Sites

In response to HB 2249, ADWR identified sites located along streams that cross State Trust lands where the underlying material is conducive to storage. In some cases, factors such as proximity of potential sites to potential places of recovery and use and/or multiplicity of potential sites located on the same stream were used to eliminate isolated or potentially redundant sites. Sites located along canals, near the Colorado River, and in areas with many existing Underground Storage Facilities were also eliminated.

ADWR ultimately identified 331 possible underground storage sites (see Figure 1) and published them in the 2021 report, *Potential Water Storage Sites on Arizona State Trust Land*. ADWR and the Storage Sites Subcommittee did not attempt to further refine the list of potential options or prioritize sites, recognizing that local stakeholders are best positioned to evaluate the opportunities available to them. This guide was developed to assist stakeholders in that process but should not be taken as specific guidance applicable to all projects.

HOW TO USE THIS GUIDE

There are six sections of evaluation criteria to this guide:

1. Initial Considerations
2. Initial Siting Investigations
3. Technical Evaluation
4. Regulatory and Permitting Considerations
5. Facility Conceptual Development
6. Facility Design

Links to websites and online tools referenced in these sections provide additional details.

EVALUATION CRITERIA #1 – INITIAL CONSIDERATIONS

Below is a list of broad, guiding questions. These questions are intended to help provide focus for potential projects and raise initial considerations. The questions and resulting answers may need to be revisited and reconsidered as the project evolves.

- What are the goals of the project?
  - Is the project intended to store water for the purposes of later recovery? Is the project intended to serve as a flood control project with an additional benefit of aquifer augmentation? Is there potential for more than one use? For example, could the project be a public park or potential wildlife habitat?
- What is the source of the water?
  - Types of water commonly stored include decreed and appropriative surface water, Colorado River water including Central Arizona Project (CAP) water, and effluent. Flood control projects and augmentation projects have potential to recharge stormwater.
- Estimating cost and potential funding sources
  - What are the potential costs of the project such as construction, operation, and maintenance costs?
  - Are there public and/or private funding sources, such as grants, that could offset some of the costs?

EVALUATION CRITERIA #2 – INITIAL SITING INVESTIGATIONS

This list of initial siting investigations is aimed at avoiding conflicts between the intended project and current land use. These investigations should be geared toward developing an understanding of the current and neighboring land uses and the individuals/entities on the land.

POTENTIAL SITES

Sites can be located on government-owned lands, such as Arizona State Trust Land, county, or city property, or on private property. Potential partnerships may be a consideration when determining a site for your project.

For example, in 2018, Flood Control District of Maricopa County adopted policy [link to policy] that makes District lands acquired and used for flood control purposes to

Lower Santa Cruz Managed Facility in Tucson AMA

be made available at no cost to Federal, State, County, and municipal agencies, and other political subdivisions of the State for aquifer replenishment. The Flood Control Completed Projects and Property portal (https://gis.maricopa.gov/Flood-Parcels/) enables these properties to be explored.

Additionally, 331 Arizona State Trust land sites are identified by ADWR in the report *Potential Water Storage Sites on Arizona State Trust Land, 2021*.

LAND STATUS

Land status refers to the current land use. It is important to determine the ownership, development, and leasing or permitting status of the land if it is not already known. Ownership information can typically be found through the County Assessor.

Arizona has more than 9 million surface acres of State Trust lands, representing approximately 13% of Arizona's total land ownership. The online ASLD Parcel Viewer (http://gis.azland.gov/webapps/parcel/) is a resource for answering the following questions:

- Is the potential storage site located on Arizona State Trust land?
- Is there a lease associated with the Arizona State Trust land?
- If there is a lease:
  - What type? (Grazing, commercial, etc.)
  - What is the land being used for?
  - What is the length of the lease?

All the information gathered using the ASLD Parcel Viewer should be confirmed by contacting ASLD to ensure the information is current.

Next, consider how the parcel and neighboring land is currently being used. For instance, projects that would require an Underground Storage Facility (USF) permit are required to demonstrate that the storage would not cause unreasonable harm to land or other water users. Could the proposed storage project impact existing development, for example, by raising groundwater levels near an underground parking garage, waterlogging nearby agricultural fields, or inundating a mining or sand and gravel operation? Also consider if the proposed facility will create noise or an eyesore that neighboring properties might oppose, or if it might attract wildlife that would conflict with existing land uses, for example, birds near an airport. Aerial photographs can be one useful resource for determining neighboring land use, and there are a number of free online sources for these, including https://www.google.com/earth/ and https://www.bing.com/maps.

ENVIRONMENTAL CONSIDERATIONS

Several environmental factors should be considered and evaluated early in the site selection process, including: the presence of landfills, the presence of nitrates, surface/subsurface contamination, groundwater wells, nearby land uses, ambient groundwater quality, and existing recharge sites.

The Arizona Department of Environmental Quality (ADEQ) maintains databases of landfills and surface/subsurface contamination at the following websites:

- Landfills – http://azdeq.gov/node/5074
- Leaking Underground Storage Tank (LUST) – use ADEQ online mapper at http://gisweb.azdeq.gov/arcgis/emaps/?topic=assessed
- Water Quality Assurance Revolving Fund (WQARF) site registry – https://www.azdeq.gov/WQARF-Registry
- Other waste programs – http://azdeq.gov/WPD

ADWR maintains a database of registered wells and permitted recharge facilities:

- Registered wells – https://azwatermaps.azwater.gov/wellreg
- Permitted recharge facilities – https://new.azwater.gov/recharge/permitted-facilities

If the proposed project is near any of the features discussed above, some questions to ask include:

- Could the proposed project cause the spread of pre-existing contamination, such as the leaching and mobilizing of natural or anthropogenic sources of nitrates present in the vadose zone?
- Could the proposed project negatively impact existing registered groundwater wells?
- Could the existing groundwater wells be used to monitor impacts from the proposed project?

The definition of "near" can be subjective and in this situation depends on the amount of water being recharged and physical qualities of the aquifer, among other variables. It is valuable to have an initial understanding of nearby sites and potential impacts, as answering these questions may require the services of a hydrologist or engineer.

OTHER CONSIDERATIONS

It may be necessary or advisable to consult with an attorney to ensure that the project will not impermissibly infringe on the rights of landowners or other water users.

EVALUATION CRITERIA #3 – TECHNICAL EVALUATION

A technical evaluation ensures the conditions of land and water are suited to the project. These investigations should determine whether the chosen site can accommodate the quantity of water to be stored or recharged and whether the project will be effective.

Some questions to consider may include:

- How do you plan to deliver the water to the aquifer? Such as, utilizing the natural channel of a stream or a constructed facility, direct injection, etc.
- What is the approximate acreage of the proposed facility?


Check Dam in the Arroyo Recharge project on the Tono Odham Reservation

Your project may require an evaluation of the infiltration rate and storage or recharge capacity of the surface and subsurface soils. Certain types of soil will allow water to infiltrate more readily than other types. For example, sand allows for relatively more and faster infiltration compared to clay. Also, some areas of the state with shallow depth to bedrock have only tens of feet of unsaturated soil thickness available to hold water underground, compared to other areas of the state where the unsaturated soil column can be hundreds of feet thick. Finally, depth to groundwater is a consideration, because groundwater near the land surface could limit or preclude potential permitted water storage. The following resources will help evaluate the soil and storage conditions at the potential site.

- The Natural Resources Conservation Service Web Soil Survey, at https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm, provides a soil type and estimated infiltration rate at the surface. It can help evaluate if the surface soil at the proposed site is conducive to storage.

- The Arizona Geological Survey Estimated Depth to Bedrock map, available as a PDF at http://repository.azgs.az.gov/sites/default/files/dlio/files/2010/u15/DGM-52Map.pdf, shows the surface geologic unit as well as mapped depth to bedrock for the entire state of Arizona.

- The ADWR groundwater level database, at https://gisweb3.azwater.gov/gwsi, can provide an estimate of the depth to groundwater at the proposed site.

Taken together, these three evaluations can provide clarity on whether the proposed site is optimal for underground storage or aquifer augmentation. Generally, sites with higher infiltration rates and extensive depths to bedrock and groundwater are preferable.

EVALUATION CRITERIA #4 – REGULATORY & PERMITTING CONSIDERATIONS

Regulatory and permitting considerations are an important part of project planning. Knowing up front what regulations and permits may be required for the proposed project can help the design/build process go more smoothly. This section identifies several of the common regulations and permits that may be needed for water storage or augmentation projects. Not all the regulations/permits listed here may be applicable to your specific project. However, there may be additional regulations or permits to consider, depending on your project.

FEDERAL PERMITS

Federal permits related to water storage facilities would generally be concerned with endangered species and/or waters of the United States (WOTUS). Online viewers and websites are available to help ascertain whether the proposed project will require one or more federal permits. These are discussed below.

- National Pollutant Discharge Elimination System (NPDES) Construction General Permit – required for any construction activity that will disturb one or more acres of land and discharges stormwater to WOTUS. See FAQs at: https://www.epa.gov/npdes/construction-general-permit-cgp-frequent-questions. Note that Arizona received authority from the EPA to administer its own version of the NPDES program, so if this permit is applicable to the proposed project, the state-run AZPDES permit would be obtained from the Arizona Department of Environmental Quality (ADEQ) instead of the federal NPDES permit.

- A permit under Section 404 of the Clean Water Act (CWA), issued by the United States Army Corps of Engineers (USACE) – required for any activity that occurs within WOTUS. The applicant would need to either assume the risk of determining whether or not the construction activity intersects WOTUS or coordinate with the USACE for a formal decision. ADEQ is working on an online toolkit to help assess which waters may be jurisdictional under the Clean Water Act. Refer to this website for more information: https://azdeq.gov/wotus.

    - State Water Quality Certification, CWA Section 401 – a state permit issued by ADEQ that is required for any project that has a federal Section 404 permit. See "State Permits" section, below, for more information.

- The United States Fish & Wildlife Service (FWS) enforces the Endangered Species Act – consultation with the FWS is required if construction activities could impact a listed species and/or critical habitat. This online viewer provides a statewide overview of critical habitat and associated species and can be used to evaluate whether the proposed project will occur within a critical habitat area:

ASR well at Tumbleweed Underground Storage Facility in Chandler

https://www.arcgis.com/home/webmap/viewer.html?url=https://services.arcgis.com/QVENGdaPbd4LUkLV/ArcGIS/rest/services/USFWS_Critical_Habitat/FeatureServer&source=sd

STATE PERMITS

Permits from the state of Arizona are broadly related to environmental concerns, archaeological preservation, protected wildlife habitat, and water resources. Information on the various agencies and potentially applicable permits is presented below.

- ASLD mission is to responsibly manage the assets of a multi-generational perpetual Trust in alignment with the interests of the beneficiaries and Arizona's future. Applications and/or permits to use State Trust lands fall under the purview of ASLD.
  - Depending on the specifics of the project, different applications and/or permits will need to be obtained. An applicant should contact ASLD to seek assistance in determining which application and/or permit will be required.

    See: https://www.land.az.gov/applications-permits
- ADEQ has a mission to protect and enhance public health and the environment. Permits related to water quality and air quality fall under the purview of ADEQ.
  - Aquifer Protection Permit (APP) – this permit may be required if a project will discharge a pollutant directly to the aquifer, or to a land surface or vadose zone where there is reasonable probability that the pollutant will reach an aquifer.

    See: https://www.azdeq.gov/APP/ComplianceAssistance
  - Arizona Pollutant Discharge Elimination System (AZPDES) – this permit may be required if in-stream recharge will occur. Consult with ADEQ to determine if this permit is required and note that the AZPDES permit would be completed in place of a federal NPDES permit. If the project requires an AZPDES permit, it will also need a Stormwater Pollution Prevention Plan (SWPPP).

    See: https://azdeq.gov/AZPDES/SWPPP
  - State Water Quality Certification, CWA Section 401 – this permit is required for any project that has a federal Section 404 permit. Refer to this website for more information.

    See: https://azdeq.gov/cwa401
- ADWR has a mission to protect, conserve, and enhance the state's water supplies. Permits related to water rights, dam safety, and underground storage fall under the purview of ADWR. Some examples include:
  - Underground Storage Facility permit and Water Storage permit – these permits are required for anyone seeking to store water in an underground storage facility.

    See: https://new.azwater.gov/recharge/applications
  - Jurisdictional Dam – for projects that include the construction of a retention structure, check if the proposed structure design falls under the definition of "dam" under A.R.S. § 45-1201. If it does, additional permitting and inspection requirements would apply.

    See: https://new.azwater.gov/dam-safety/faq
  - Notice of Intent – If the project will deliver water to the aquifer via wells, this form is required to be submitted to ADWR in advance of drilling, modifying, or abandoning any type of groundwater well.

    See: https://new.azwater.gov/permitting-wells/well-forms-and-applications
- The Arizona Game and Fish Department (AZGFD) is tasked with managing, conserving, and protecting wildlife, including non-game and endangered wildlife. Although not associated with any permit requirement, if the proposed project falls within a critical habitat area (see Federal section, above), coordinating with the AZGFD prior to contacting federal agencies is recommended.

- The Arizona State Historic Preservation Office (SHPO), part of the Arizona State Parks Department, assists in the identification and protection of historic and archaeological properties that have significance for local communities, the state of Arizona, and/or the nation. Consulting with the SHPO prior to conducting groundbreaking activities is recommended to ensure that cultural resources are not inadvertently impacted.

COUNTY AND LOCAL PERMITTING

County and local jurisdictions may have their own set of permits or constraints. For example, Maricopa County requires Dust Control Permits when earthmoving operations disturb an area greater than one tenth of one acre, whereas Pima County requires a Fugitive Dust Activity Permit when earthmoving operations disturb over one acre. Check with the specific county to understand what is applicable for the proposed project.

EVALUATION CRITERIA #5 – FACILITY CONCEPTUAL DEVELOPMENT

The following are some considerations for the physical design of the storage facility. Some of these items address near-term project logistics while others are long-term considerations to ensure the project is functional and provides the intended benefit for the projected lifespan.

- How will you measure the effectiveness of the project? Will there be groundwater monitoring or other professionally accepted methods to estimate the benefit of the project to the aquifer?
- What is the anticipated lifespan of the project? What will long-term care of the project look like, such as anticipated operation and maintenance requirements?

Water being delivered to recharge basins at the Tonopah Desert Recharge Project

EVALUATION CRITERIA #6 – FACILITY DESIGN

Focused investigations that would occur after the high-level planning is completed will likely need to be conducted by consultants who specialize in subsurface and water-related projects in Arizona. Costs for these investigations can range from tens to hundreds of thousands of dollars, depending on the site-specific characteristics and complexity.

- Subsurface investigations
  - Deep – borehole drilling to characterize alluvial material; tests to evaluate the potential for onsite leaching of pollutants (nitrate) through the vadose zone
  - Shallow – test pits; cylinder infiltrometer tests to characterize surface material
- Hydrologic/hydraulic calculations
  - For example, catchment design
- Engineer design plans and opinion of probable cost

SUMMARY

The scope of underground water storage and aquifer augmentation in Arizona varies from one or more injection wells to constructed basins to large-scale managed underground storage projects to flood control projects and low

impact development measures. Underground water storage and aquifer augmentation projects have been sited and constructed in many locations across the state. The links below provide examples of existing projects:

1. Cochise Conservation & Recharge Network
   https://ccrnsanpedro.org
2. City of Kingman Reclaimed Water Injection Well
   https://www.cityofkingman.gov/Home/Components/News/News/1557/255?arch=1
3. Salt River Project's Granite Reef Underground Storage Project and New River-Agua Fria River Underground Storage Project
   https://www.srpnet.com/water/resource-management.aspx
4. Town of Prescott Valley Effluent Recharge
   https://www.pvaz.net/244/Water-Reuse-Recharge

A recharge basin at the multi-use Gilbert Riparian Preserve Recharge Facility is also designated as an urban fishing resource through the Arizona Game and Fish Department.

This Governor's Water Augmentation, Innovation and Conservation Council document has been prepared by the Arizona Department of Water Resources, and outlines the steps and considerations for potential underground storage of water in Arizona.